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ABSTRACT

Three presentations are provided from Symposium 39, Integrating Learning with Working, of the Academy of Human Resource Development (HRD) 2000 Conference Proceedings. "Constructing Knowledge in Continuing Professional Education [CPE]" (Barbara J. Daley, Merryl Carlsson) reports an analysis of the interrelationships between professional practice, knowledge gained in CPE programs, and context of employment that found professionals construct a knowledge base by moving back and forth between CPE programs and their professional practice. "How Important Is Education for Learning To Work?" (Richard J. Torraco) addresses the following: (1) reviews literature on work and the expertise needed to perform it, from studies of both individual and collective expertise; (2) examines the research methods available for conducting such studies; and (3) proposes a framework for further study of the issue of integrating prior learning and experience with the present demands of a task to perform it skillfully. "Critical Reflection on the Shop Floor" (Marianne van Woerkom, Wim. Nijhof, Loek F. M. Nieuwenhuis) reports a study describing on-the-job learning that found flexible craftsmanship is no neutral measure of output because it takes into account only the employer's view of ideal employees. Critical reflection is suggested as a more neutral measure. The papers contain reference sections. (YLB)

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Symposium 39

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Constructing Knowledge in Continuing Professional Education

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This qualitative interpretivist study analyzed the interrelationships between professional practice, the knowledge gained in continuing professional education programs, and the context of employment. Sixty semi-structured, tape-recorded interviews were conducted with social workers, lawyers, and nurses who had attended continuing education programs nine-24 months previously. Findings indicate that professionals construct a knowledge base by moving back and forth between continuing professional education programs and their professional practice. This process of knowledge construction was affected by elements of the structural, human resources, political and symbolic frames of the contexts in which professionals were employed. Implications for further research in continuing professional education are drawn.

Keywords: Continuing Professional Education, Constructivist Learning, Transformative learning

The intricate, elaborate, and dynamic relationship among learning, context, and professional work is one that has recently begun to be explored from a new perspective. Research in the transfer of knowledge (Broad & Newstron, 1992), adoption of innovation (Hall & Loucks, 1981; Lockyer, 1991), and diffusion of innovation (Rogers, 1995) has laid the groundwork for the study of learning and context. However, in these frameworks, research questions have asked how does knowledge learned in one location get transferred or applied in a different location. The complexities inherent in the transfer process have led researchers to attempt to simplify their studies by looking at transfer, adoption, and application as linear, one-way processes of translating information into professional practice.

More recently however, researchers and program planners (Black & Schell, 1995; Eraut ,1994; Gray-Murray, 1994; Grzyb, 1997; Kozlowski, 1995) have begun to understand that professionals engage in a more interactive process with the context of their practice and tend to combine elements of the context, information from continuing education, and experience in practice to construct their own individual knowledge base, rather than to follow a simple transfer process. Even though researchers have begun to question the relationships between knowledge presented in continuing education programs (CPE) and the use of that knowledge at the work site, the missing element is still a comprehensive, holistic assessment of the interrelationships between the learner, the knowledge generated within the educational program, the components of professional practice, and the context of organizations in which professional are employed.

The purpose of this paper is to describe a research study that emanated from questions raised about the value of CPE programs. The use of knowledge in professional practice is an important issue within the field of adult education because billions of dollars are spent on CPE programs without a clear understanding of the outcomes of the learning or the connections between learning and the context of practice.

Theoretical Framework

The interrelationships of three major concepts; knowledge, context, and professional practice were explored in this study. Knowledge, for the purpose of this study, was viewed as a social construction of information that occurred through a process of constructivist learning and perspective transformation. Merriam and Caffarella (1999) have defined constructivism as a collection of theoretical perspectives that includes both constructivist learning theories and transformative learning theories. They indicate that constructivist perspectives are about making meaning.

Constructivist's (Ausubel, 1986, 1978; Brunner, 1990; Dewey, 1938; Novak, 1998; Novak & Gowin, 1984; Piaget, 1971) believe that individuals create knowledge by linking new information with past experiences. Within a constructivist framework, the learner progressively differentiates concepts into more and more complex understandings and also reconciles abstract understanding with concepts garnered from previous experience. New knowledge is made meaningful by the ways in which the learner establishes connections among knowledge learned, previous experiences, and the context in which the learner finds themselves. Lambert and others (1995) identify multiple principles of

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constructivist learning theory. These principles include the following major points: (1) knowledge and beliefs are formed within the learner, (2) learners personally imbue experiences with meaning, (3) learning activities should cause learners to gain access to their experiences, knowledge and beliefs, (4) learning is a social activity that is enhanced by shared inquiry, and (5) reflection and meta-cognition are essential aspects of constructing knowledge and meaning (p. 17-18). Thus, constructivists believe that learning is a process of probing deeply the meaning of experiences in our lives and developing an understanding of how these experience shape understanding. Within a constructivist framework, learning activities are designed to foster an integration of thinking, feeling and acting while helping participants to learn how to learn (Novak & Gowin, 1984).

Learning in the context of professional practice is also informed by the growing body of work in the area of situated cognition (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991; Wilson, 1993). Situated cognition can be conceptualized as having four interrelated learning aspects: (1) learning that is situated in the context of authentic practice, (2) transfer limited to similar situations, (3) learning as a social phenomenon, and (4) learning that relies on use of prior knowledge (Black & Schell, 1995). In this view, the authentic "activity in which knowledge is developed and deployed ... is not separable from, or ancillary to, learning and cognition. Nor is it neutral. Rather, it is an integral part of what is learned" (Brown et al., 1989, p. 32). According to Wilson (1993),

> Learning is thus an everyday event that is social in nature because it occurs with other people; it is 'tool dependent' because the setting provides mechanisms (computers, maps, measuring cups) that aid and, more important, structure the cognitive process; and, finally, it is the interaction with the setting itself in relation to its social and tool-dependent nature that determines the learning (p. 73).

Lave (1991) has indicated that authentic activity and tools within the context of use helped foster the construction of knowledge.

Transformative learning (Mezirow, 1981, 1990, 1991, 1994, 1997) expands our understanding of constructing knowledge by defining learning as a critically reflective process where the learner ultimately reflects on assumptions that frame previous understandings and determines whether those assumptions are still valid in the learner's present situation. Adults learn within this framework by adding to old meaning schemes, acquiring new meaning schemes, transforming meaning schemes, or transforming perspectives. According to Mezirow (1997), "a significant personal transformation involving subjective reframing, that is, transforming one's own frame of reference, often occurs in response to a disorienting dilemma through a three-part process : critical reflection on one's own assumption, discourse to validate the critically reflective insight, and action" (p. 60).

The issues in the relationship of context to professional practice are particularly important in today's environment because professionals are often considered employees of organizations rather than free, autonomous decision-makers (McGuire, 1993). Grzyb et al. (1997) point out that these changing conditions necessitate a deeper understanding of organizational professions, the impact of bureaucracy, and changing organizational dynamics on professional work. Cervero (1985) included the identification of the social system (context) as a variable with impact on the outcome of continuing education programs. "This may be the most powerful, yet overlooked, variable in analyzing the effectiveness of continuing professional education" (p. 87).

To provide a framework for examining the context of professional practice, Bolman and Deal's (1997, 1991) framework was selected. Bolman and Deal (1997) demonstrated that organizations can be viewed through four different lenses or frames, including the structural, human resources, political, and symbolic frame. The structural frame draws on concepts from sociology and emphasizes formal roles, defined relationships, and structures that fit the organizational environment and technology. Within the human resources frame it is believed that organizations have individuals with needs and feelings that must be taken into account so that individuals can learn, grow, and change. The political frame analyzes the organization as groups competing for power and resources. The tools of this frame are bargaining, negotiation, coercion, and compromise. Finally, the symbolic frame (similar to organizational culture) abandons rationality and sees organizations as tribes with cultures propelled by ceremonies, stories, heroes, and myths. Bolman and Deal (1991, 1997) believe that organizations can be understood, analyzed and changed by using different lens and/or frames as ways to approach organizational issues. This framework was selected for the research reported here, because it provides different lens by which the researchers can examine and analyze the context in which professionals conduct their practice. The framework also provides a method by which the researchers can compare and contrast the impact of context on different professional groups.

Research Questions

The following research questions were advanced to guide this inquiry.

1. What makes knowledge meaningful in the context of professional practice?
2. How is the construction of knowledge affected by the different frames (structural, political, human relations, symbolic) of the context in which professionals practice?

Methodology

To analyze the above research questions, individuals from three different professions were interviewed 9-24 months following their attendance at a CPE program. A purposive sample (Patton, 1990) of 20 social workers, 20 lawyers, and 20 nurses was recruited. Professionals ranged in age from 22-60, and had between 1 and 20 years of experience in their professions.

Data Collection Data in this study were collected through semi-structured interviews and document analysis. Following human subjects approval, data were collected from participants who had attended a one or two day CPE program on topics that were pertinent to their particular profession. Prior to completing the tape-recorded interviews, the researchers conducted a document review of the continuing education planning information that specified the program objectives, content, time frames, and evaluation strategies of each CPE program from which study participants were drawn. Participants were then questioned to determine what they had learned or not learned, how they incorporated or not incorporated that information into their practice, and what aspects of their practice (clinical cases) they determined to be significant in fostering their learning. Participants were also questioned about the context of their practice including, the organizational structure, human resources, politics, and culture. Ten of the 60 interviews in this study were completed over the telephone, but the majority of interviews were conducted in a face to face meeting between the researchers and participants.

Data Analysis Verbatim transcripts were created from the tape-recorded interviews. Subsequently, three data analysis strategies were employed. First, the researchers created a concept map (Novak, 1998) that depicted the connections the study participant described among learning, context, and professional practice. The maps were used to assist the researchers in tracing the interrelationships between the concepts under study. The maps created were returned to study participants for their review. Study participants were asked to determine if the maps accurately represented the meaning they portrayed in the interview. Second, a category system was created and all data were coded within categories. The categories were used to identify thematic areas articulated by participants. Third, a system of matrices (Miles & Huberman, 1994) was created to examine what different groups of participants expressed about each of the research questions under study. The combination of these three data analysis strategies allowed the researchers to examine connections between concepts under study, to compare and contrast different groups in the sample, and to examine both individual and group findings related to the different research questions.

Quality Control Two quality control mechanisms were employed in this study. First, member checks were employed during the interview process and the study participants reviewed the concept map created from their interview for accuracy and completeness. Second, two qualitative researchers are currently completing a qualitative data analysis audit to review the study for dependability and confirmability (Lincoln & Guba, 1985). Preliminary findings from the audit indicated that the methodological decisions (dependability) made during the process of the study were sound and that the study findings were confirmable in the data.

Results

Knowledge and Professional Practice Study results indicate that professionals who attended CPE programs used this new information to continually construct and reconstruct their knowledge base. Professionals in this study did not see transfer of learning as an outcome, but rather transfer was viewed as an integral part of the knowledge construction process. The new information learned in CPE programs was added to a professional's knowledge base through a complex process of thinking about the new information, acting on the new information and identifying their feelings about the information. It was through this process that knowledge from CPE became meaningful.

Each profession described the process used to construct knowledge differently.

Social workers framed their understanding and construction of knowledge from CPE programs through their advocacy role. Social workers described themselves as "stewards" of the information and explained how they actively sought our ways they could help their clients by using information learned in CPE.

> *I went to that session thinking about the future more and wanting to know what was going to be happening with the social work profession in the near future especially . . . with the W2. I guess it was a broader thing, a more political interest that I had, how could I use what I learned to help defend my clients needs in the system.*

Lawyers, on the other hand, tended to develop their own systems to construct knowledge. Lawyers saw CPE as providing a "road map" for their practice. During attendance at a CPE program, lawyers would often create their own individual ways to link new legal information to the cases on which they were currently working by developing note taking or filing systems. For example, one lawyer indicated:

> *I had represented a guy who had custody of his children but he owed support from 16 years ago. I tried to get the amount reduced because he had his kids, but he still owed it to the welfare department from his wife having the kids when they were one and two years old. And now the kids are 20 and 21,. . . I heard something in the seminar that made me think there is some ammunition here that I could use in a motion for the court to reconsider. So I jotted that down and made sure to include it in his file and used it when I filed the motion.*

Lawyers also indicated that their understanding of how they constructed knowledge changed as their practice developed. Lawyers indicated that they moved to a much more active incorporation of information into their knowledge base as they gained experience in their profession.

> *When I first started taking CLE programs 19 years ago, they werent much use to me because I didnt know what to do with them. I was a young lawyer and I needed credits and somebody said you really ought to go to this seminar with me and that was great, but I wasnt that integrated into child practice or real estate law which were my things at that point. So not having had a background where I discovered the need for some of this information, I didnt know what to do with the information. It was only as a more established lawyer that I really understood what I wanted and really needed and would try to go out and get it.*

Finally, nurses described how they linked client needs, with new information from CPE so that the entire knowledge base became integrated. This knowledge base functioned more like a web of information that nurses would draw on when presented with new clients. Consider the nurse who describes this process as follows.

> *I mean I cant really say what helps me dealt with what. I think of it more like creating mosaics. I mean, you have all these little pieces that come from all over and in and of themselves they dont mean much, but when you put them together you have a beautiful picture. Continuing education and client care are more like that for me. I take little pieces of what I learn from many places and put them together until I have my own picture.*

In summary, each profession indicated that knowledge became meaningful through a process they used to link the information with their practice. Because of their advocacy role social workers saw themselves as stewards of information, conversely, nurses saw themselves as creating mosaics, and lawyers described the CPE process as a road map for their practice.

As indicated previously, constructivist learning theory can help us understand how professionals acquire knowledge, how they make use of their experiences and how they learn through their practice. But the results of this study indicated that, there is another level of learning that goes beyond what we can understand from constructivist frameworks. Professionals described how they learned topics in educational programs only to have their ideas on those topics changed in the context of practice. Often, it was an emotional encounter with a client that changed a professional's practice. In other words, these encounters were as important in transforming professionals' perspectives as was the knowledge acquired in CPE courses.

For example, a nurse in this study described how she saw herself as a relatively good communicator. She had learned communication theory in her basic prepatory program, reviewed it in CPE programs and practiced the skill with her clients while doing assessments, interviews and treatments. When she worked with a client who was dying, however, this client taught her what it meant to communicate. Her understanding of communication shifted from saying the right thing, to being available on the client's terms.

My assumption was that if I said the right words, I was communicating well. After this experience I recognized that I was basing my actions on a view of communication that was not really accurate in my practice. I now believe that communication is about presence, caring and time, not just words.

In this example, the professional learned by constructing an understanding of the concept of communication and by changing her perspective and assumptions about what communication meant following a significant practice experience.

In another example, a social worker described how her understanding of resistance in working with involuntary clients changed her views on the connections between social work and politics. She indicated that her basic education "labeled people as resistant." She explained the impact of her practice on this perspective:

When somebody comes to you with a problem, I learned that you dont have to spend as much time fixing that person as you do fixing the things around them in the environment. If you listen, you know it is not so much resistance; but its racism, its poverty. I learned to reconceptualize resistance and focus not so much on the individual in a therapeutic sense, but to focus on the system, and to be an advocate at the system level.

This social worker indicated that she had constructed a new meaning of the concept of resistance through her practice and that she had transformed her perspective so that her interventions with clients were on a much broader level.

Finally, a lawyer in this study indicated how his views on dealing with divorce cases had changed. He indicated that during his initial education process he had learned to be very aggressive in assuring financial security for his clients. He explained that after dealing with many divorce cases his perspective changed.

When I first started practicing, I would become very aggressive in divorce cases about dividing up assets. That was what I learned, I made sure that I evaluated assets to maximize my clients side of the ledger and I made sure they were divided in such a way that my client would get absolute top dollar and I would fight very forcefully and aggressively to do that. When I look at things now, after dealing with many cases, I think it is important that people get the dollar amount that they should, but I think there are other aspects that come into play also, like a continuing good relationship between the husband and wife if it is possible to preserve that. Not thinking that the dollar is the end all and be all, and that there are other more important things rather than getting the most possible money out of a given situation such as preserving relationships, such as continuing good relationships with the children, such as peace of mind, such as not spending a great deal of money on attorney fees. . . such as avoiding a trial and the trauma and the bad relationship that can carry over for years and years and years between parties.

This lawyer indicated that he had constructed a new understanding of divorce outcomes and shifted his practice from a focus on the financial aspects, to a focus on the human aspects of the process. Thus, a major component of how knowledge becomes meaningful in professional practice is determined by how the professionals' perspectives change following client interactions.

Context The complex process of knowledge construction and transformation described in the previous section of this paper, occurred in a particular practice context as well. So not only did the content of the CPE program, and the professional practice shape the construction of knowledge but the context in which professionals worked added another level of complexity to the process.

Overall, the main difference study participants described in the context of their practice related to the level of autonomy and independence they possessed as professionals, or the extent to which their practice was housed within a bureaucratic system. The practice of nurses tended to be housed mostly in bureaucratic health care systems where structure and politics impacted the professional work in which the nurse engaged. The practice of social workers was either housed in governmental agencies, where both macro and micro political issues impacted the work of these professionals, or social workers practiced independently as therapists and thus, had a greater degree of autonomy. Lawyers, for the most part, appeared to be the profession in this study that demonstrated the most autonomy and independence. Whether lawyers were working in large firms or small firms, there seemed to be less impact of the context on their professional practice. Each professional interviewed, for this study, was asked to explain specifically how the structural, human resources, political and symbolic frames of the context of their work environment impacted knowledge development.

Structural frame. Each of the three professions, lawyers, nurses and social workers described the impact of the structural frame in a unique way. Lawyers, for the most part indicated that the structural frame had little impact on their

use of knowledge. Lawyers indicated that because of the autonomous nature of their practice, if they learned new information that they wanted to use with a client they did so with very little concern about the structure of the firm. Nurses, on the other hand described the structure of their organizations as a "hurdle", and indicated that to use new information in their practice they often had to find creative ways to go around the organizational structure. For example, nurses indicated how they often had to "break rules" to make sure their client's needs were met. Social workers seemed to feel that the use of new information that would benefit their client was an individual responsibility and they felt obligated not to let the structure of the organization get in the way. Social workers described how they would take information from CPE programs and use it with clients even if that meant going outside an organizational policy. It was interesting to note, however, that social workers who were employed in health care described the structure of the organization similar to the way nurses described the structure. Social workers employed in health care organizations felt there were more structural hurdles to the use of new information than social workers in private practice or governmental agencies.

Human resources frame. All three professions indicated that other people in the organization were for the most part encouraging and supportive to using new information in their practice. Nurses and social workers indicated that their "bosses and colleagues" were usually open to new ideas and willing to try new things, as long as "the ideas weren't too far out". Nurses and social workers expressed that they often talked with colleagues about new ideas or "just to run things by them" before trying something new. Additionally, the nurses and social workers who had more years of experience in their practice seemed to more openly discuss practice issues, concerns and new methods for providing care than did their younger colleagues.

Lawyers, however, were often in individual and solo practices, as a result, the human resources issues affected them differently. Lawyers indicated that they often had to seek out other people so that they had a colleague to talk with about new ideas. Lawyers indicated that people they worked with did not get in the way of using new information, but rather the issue was not having enough easily accessible colleagues with whom to talk. Many lawyers in this study developed informal colleague networks of individuals with whom they could interact. Sometimes these were infrequent lunch or breakfast groups that met when an issue arose and other times they were structured groups that met on a routine basis. The interesting finding here was that these were groups created for the express purpose of sharing ideas in practice, but these groups were created outside of a CPE mechanism. For example a lawyer in this study described a group in which she was involved.

> *. . . there are 8-9 female attorneys that are about my age that get together once a month. It started when we all felt burned out and we had to talk to someone, since we are not in a firm, you need someone to bounce things off of. It started out being the burned out ladys' lawyers' luncheon. We were named that by one of the other peoples' male secretaries. You know, 'Those burned out lady lawyers are going to lunch". Now we are the BOLLL. We meet at a restaurant, once a month on Fridays. And they put us up on the bulletin board BOLLL and everyone goes, whats that?*
>
> *We interact and maybe we will help each other. If I have a form that I think is useful, I will share it. Or if someone used a new appraiser in a certain County to appraise a house that we dont know about, we will share that information. If somebody learned anything in a seminar that someone else was at or had a case that was different, we kind of bounce ideas back and forth. We talk about psychologists that do evaluations and custody cases or maybe hints on how to deal with other difficult attorneys, because in family law, sometimes the hardest thing is dealing with the other attorney. It is so confrontational because the parties are not getting along or they wouldnt be going through a divorce. So a lot of times it seeps over into the other lawyer and your worst enemy when you are doing a divorce can be the other lawyer. So we talk about how to deal with that. . .*

Political frame. In each of the professions interviewed, the political frame was used in a different manner. Lawyers seemed to ignore the political frame and incorporated whatever information they needed in their practice. It is not that lawyers were unaware of political issues, but rather that the political issues did not impact how they used information from CPE programs.

Social workers were well aware of the political frame and used information from CPE programs in what they saw as their advocacy role. Social workers were very well aware of both the macro and micro political issues that impacted their work, and yet, would indicate that "just because a door is closed, it does not mean it is locked." Social workers expressed that their role as an advocate was political and as such, they felt it imperative that they not only understand the politics of the contexts in which they worked, but that they be able to work in the political realm to help meet their clients' needs.

In contrast, nurses would literally screen out information from CPE programs if they believed the political context would prevent its use. For example, nurses indicated that they would not even share information from CPE programs if they felt they did not have the power, money or time to use the information.

Symbolic frame. For nurses and social workers it appeared that the political issues of their practice seemed to define the symbolic frame in many ways. The issues of gender, power, change, money and time all initially arose from the political frame but became imbedded in the organization as part of the symbolic frame. So for nurses and social workers there did not seem to be a real clear distinction between these frames. Lawyers described one element of the symbolic frame that did have an impact on their use of knowledge. Lawyers described how their work was set within an adversarial system and that their use of knowledge was often done as a mechanism to "defeat the other side" or to "win the case". Lawyers would describe that they felt good in their practice when they could "obtain an outcome for their client that the client wanted."

Implications for the Practice and Research in Adult Education

This study raises a number of questions and implications for adult education specifically, in the area of continuing professional education. First, it suggests a major research question in the field of continuing professional education: Is application of knowledge an outcome of continuing education or part of the knowledge construction process? This study supports Detterman's (1993) position that there is no general cognitive skill that promotes learning transfer, and thus the importance of contextualized learning is emphasized. Perhaps, this study should be replicated across additional disciplines to determine if other professions integrate new knowledge in a similar fashion to the three described here. Additionally, the field of human resource development (HRD) shares with CPE an interest in context and learning. Questions raised in this study are pertinent to HRD and need evaluation in an HRD context as well. Specifically, the role of HRD in developing learning communities, organizational learning processes, and professional competencies would benefit from an examination of learning and context.

The role of a CPE provider, as indicated in this study, is much more than simply designing programs so professionals can adopt new information in their practice. The role of the CPE provider is facilitating a process of learning, reflection, growth and change. Study findings indicate that adult educators need to come to a new understanding of learning and context. No longer can education be seen as the provision of learning materials and educational programs to the individual. In today's complex, fast changing, technology enhanced environments it is incumbent on adult educators to view the learning as situated in a unique context and to consider how this context enhances, detracts or shapes the learning of the individual. In other words, "the unheralded importance of activity and enculturation to learning suggests that much common educational practice is the victim of an inadequate epistemology. A new epistemology might hold the key to a dramatic improvement in learning and a completely new perspective on education" (Brown, Collins, & Duguid, 1989, p. 41). As professionals continue to be integrated into organizations the linkages between context and practice need to understood, defined and analyzed so that learning and professional practice can continue to grow in these new contexts.

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How Important is Education for Learning to Work?

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Work and the expertise needed to perform it have been the subject of studies of the individual craftsman, small groups, cross-functional teams, occupations, and settings in which workers from diverse backgrounds must function. This paper reviews literature on this topic at each of these levels—from studies of individual to collective expertise. Then, the paper examines the research methods available for conducting such studies. The core question addressed by this literature is , "How do people integrate prior learning and experience with the present demands of a task to perform it skillfully?" A framework for the further study of this question is proposed and justified.

Keywords: Skilled performance; Work analysis; Ethnography

Studies of work and the expertise needed to perform it range from studies of a single worker to meta-studies of groups of workers with diverse occupational backgrounds. Research has examined the skills of a single craftsman (Harper, 1987), a group of two or three people working closely together on the same task (Pinch, Collins and Carbone, 1997; Suchman and Triggs, 1993), the work of those in an occupational group (Henning, 1998; Hutchins, 1993; Orr, 1996), the skills required by those with different jobs, yet all within high technology (Darrah, 1994; Dubinskas, 1988; Kunda, 1992; Pentland, 1992), manufacturing (Giordano, 1992; Graham, 1993; Scribner, 1984), or health care (Cicourel, 1990; Nelson, 1997; Scarselletta, 1997). Other studies have examined the skills of technicians in a wide variety of occupations (Barley, 1996; Barley and Orr, 1997). Some researchers have extended their studies to workers with diverse occupational and demographic backgrounds (Hodson, 1998; Zuboff, 1988). The next section reviews literature that ranges in scope from studies of individuals to studies of collective expertise.

Individual craftsman. Harper (1987) studied of craftsmanship and resourcefulness of the owner of a small repair shop. Because of Willie's expertise, the subject of Harper's fascinating book, automobiles and a wide range of non-automotive equipment were brought to the shop for repair. Harper used interviews with Willie, photographs of the work environment, and detailed accounts of different kinds of repair projects to describe Willie's remarkable ability to fix almost anything by improvising with whatever odds and ends were available. Harper portrays Willie as the embodiment of Levi-Strauss's (1966) *bricoleur*—the odd-job man or jack-of-all-trades who makes innovative use of left over bits and pieces to solve emergent problems. Willie is shown to be a skilled craftsman who moves from one repair problem to the next, constantly identifying potential solutions by making use of *what is available* around the shop. Harper's account shows the importance of Willie's continuous learning to the quality of his work as he improvises methods to fix all types of equipment including old tractors, grain silo pumps, and wooden structures near his shop.

Working on a common task. Pinch, Collins, and Carbone (1997) addressed the issue of how hard a given task is to perform and how hard one should work at it before giving up. The authors provided ample justification for the importance of this issue by showing how widely the estimation of the difficulty of a task is used. Technical workers and craftsmen (for example, plumbers, mechanics, and carpenters) often have to price jobs by estimating how difficult the jobs are to complete. Managers often estimate the complexity and importance of a task to determine whether or not they have time to address it. The authors provided two detailed accounts of the work of veterinary surgeons performing abdominal surgery to geld a 15-month old horse (that is, remove the testicles) and to spay a female ferret (that is, remove the uterus). The methods for studying this work included observation, the study of surgical training films, unstructured interviews, and audio and video recording.

The description of the surgery to spay the ferret demonstrated how the estimation of difficulty might be used to improve surgical practices and the importance of experience in dealing with the unforeseen difficulties that often arise in surgery. Upon entry to the abdominal cavity, the surgeon should have been able to find the uterus almost immediately, but instead he had to backtrack through a process of mapping the location of internal organs and tissues that identify the location of the uterus. The study provides a verbatim account by the surgeon and the surgeon's assistant of the process of trying the location and remove the uterus. After nine and a half minutes of surgery the uterus could not be located. The surgeon began closing up the abdomen while discussing with the

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researchers the possibility that the animal was a actually a male ferret. Perhaps the animal was a hermaphrodite or had prior surgery disguising its sex. Even at the termination of surgery the surgeon could not be certain about the animal's status. Should he have spent more time searching for the uterus? Did this particular ferret possess anatomical anomolies? Would a more skilled surgeon have found the uterus right away? In part because the difficulty of this task is known (if a uterus is present, it should be readily located), the surgeon became suspicous right away and ended the surgery in about nine minutes. The authors discussed the utility of expressing task difficulty in a ubiquitous language such as using numbers, as long as the numbers could be understood in context. The difficulty of a task can be roughly expressed in the length of time needed to complete it or in the number of iterations it should take to achieve success or failure. A veterinary surgeon should be able to find a normal ferret's uterus within a few minutes. For a horse with undistended testicles (they are retained in the abdomen, not in the scrotum where they should be), locating them will take longer but the time estimate needed for this is known. The authors have told their perplexed graduate students to expect to redraft an academic paper at least a dozen times, whereas a term paper may only need one revision. They conclude that learning the difficulty of a skill is an important aspect of training the technical workforce.

Suchman and Trigg (1993) examined the work of artificial intelligence (AI) researchers engaged in solving a particular technical problem as a way of understanding the professional practice of artificial intelligence. The researchers studied were delegating human competence to machines by developing scenarios of real activity as text, transforming these scenarios into abstractions (graphics and symbols), and writing computer programs for "intelligent machines." The episode of technical work described by the authors involved the exchange between two researchers during a session in a corporate AI laboratory devoted to knowledge representation— a central task in AI work. Working on a computer program to model "situated inference" about time, place, persons, and events, the two researchers were designing a meeting scheduler capable of interacting with a hypothetical user to maintain a weekly calendar of events. The problem is to encode the scheduling rules in such a way that the system could use them successfully at a later time.

The authors videotaped the working session in which the AI researchers discussed the problem and mapped it out extensively on a whiteboard in the laboratory. Verbatim exchanges from the key parts of the discussion provide insight to the expertise of the researchers and to the nature of AI as craftwork. The researchers' work with AI is described as a series of representations moving from a simplified textual scenario of a real world experience, to a graphical abstraction of the scenario, to inscription of this abstraction as code on the machine, and finally, to a reconnection of the machine to the world through its interaction with a human user. The scenarios, abstractions, code, and programs comprise the objects of the work discussed by the researchers. These objects mediated between the real experiences being modeled and capabilities desired from the machine.

Work within different occupations. Henning (1998) studied the work and learning that occurred among a group of refrigeration service technicians over a seven-month period. Using situated learning as the theoretical foundation, Henning's ethnographic study examined the principal kinds of learning among seven technicians with different levels of formal training and job experience. Adopting the ethnographer's interest in capturing the experience from the participants' perspective, Henning extensively observed the technicians in the supermarket compressor rooms where they performed much of their work. Unstructured interviews with technicians were documented through field notes and audiotapes. Observations and interviews were supplemented with videotaping of routine and unusual service events and the analysis of documents and other artifacts.

Three types of learning in which the technicians were engaged were described by Henning. Learning occurred through the physical and technical objects in the work environment, through particular forms of discourse and communication, and in the social relationships that were built around the service department. Objects present in the technicians' work setting such as compressors, refrigeration cases, and heat reclamation systems allowed learning through sensory impressions from sight, smell, touch, and sound. Learning occurred during discussions of typical problems encountered by technicians and through stories about unusual or noteworthy repair situations. Learning also arose from social relationships among the servicemen, their supervisors, and others with whom they interacted frequently on the job. In managing the interpersonal and technical challenges associated with refrigeration equipment in the supermarkets for which they were responsible, the technicians used locally available resources and each other to learn and improve their refrigeration service skills.

Hutchins (1993) provides an in-depth account of the expertise required for navigating large ships. Responsibilities are distributed among the members of a navigation team composed of three to six members, depending on the size of the ship. Members of the navigation team who are not located in the pilothouse interact continuously using radios, closed-circuit television, and visual contact. This is especially important for error-free navigation in confined or busy waterways. The career trajectories of naval navigators are such that most members of the team have previously held the positions of one of their junior colleagues. Advancing through progressively

difficult navigation jobs allows for the overlapping distribution of expertise among members of the team. The expertise for navigation is not fully captured by any single member's conception of the navigation task. As Hutchins (1990) observes, "[The] sequence of actions to be taken need not be represented any where in the system. If participants know how to coordinate their activities with the technologies and people with which they interact, the global structure of the task performance will emerge from the local interactions of the members" (p. 209). The distributed nature of the expertise required for naval navigation and other group work has implications for workplace learning that are examined next.

Detailed accounts of how photocopier repair technicians resolve the problems encountered in restoring a malfunctioning photocopier to working order emphasize the crucial contribution of contextual understanding to the development of their skills. Beyond basic technical expertise, technicians need a richer understanding of the social context of how photocopiers are designed and used. Orr (1990, p. 171) makes the following observation about successful photocopier repair work:

> [Photocopier repair] is not simply a matter of finding out what is wrong with the machine; there may be nothing wrong with the machine as a thing, in and of itself. The problem may rather lie in the interaction of the machine as it is, the uses its designers anticipated for it, and the uses, methods desired, understood and chosen by the customers. The designers' interpretation of how one would use the machine cannot preclude other interpretations, but the others, because unanticipated, may be unsuccessful. This may appear to be a problem to the customer whose interpretation of how to use the machine fails.

Diagnosis of the malfunction is complicated because the state of the machine is often unclear— a technical problem that is resolved through the social interaction of the technician, customer, and machine. Technicians' skills must not only include techniques for machine diagnosis and repair but a broader understanding of the social context of use in which customers make demands of the machine, regardless of designers' intentions. Accurate reconstruction of the machine-user interaction is rarely possible for technicians, though such insight would greatly expedite the repair process. Instead, technicians must construct their own representation of the problem as the basis of making repairs. Problems that cannot not be fully anticipated in advance demand contingent responses; the use of scripted repair procedures by technicians is insufficient.

Moreover, the sharing of knowledge among members of the technician community is crucially important to the service task. Typical of the encounters described by Orr is a discussion between two experienced technicians exchanging quite different views on what to do about a malfunctioning machine. One technician interprets an error code from the machine literally, whereas a second technician believes the code to be a red herring, and, in following a different diagnostic path, discovers new problems that ultimately lead to the real source of the machine's breakdown. Through the continuous sharing of their experiences, technicians construct a broader base of knowledge than any one technician possesses.

Different occupations within a common industry. Giordano (1992) described how the work of four related occupations— machinists, draftsmen, design drafters, and engineers— was changing in the face of computerization within a major defense contractor. She found that two distinct types of machining expertise were emerging from these changes: the manual skills that have traditionally defined this occupation, and the abstract, cognitive processes now needed by machinists to transform computerized information into precisely machined parts. Although automation simplifies and, in effect, deskills parts of the machinist's job, the overall effects of computerization on machining increase the skills required of machinists who must now program and operate advanced machine tools. She also found that technology now allowed not only the rearrangement of tasks, but the reclassification of entire jobs. For example, it is now conceivable that the machinist's role, long crucial to basic manufacturing processes, could be eliminated as engineers become capable of programming and operating machine tools from their computer terminals. Thus, technology not only upgrades the capabilities within a job, it reshapes the distribution of work at higher levels as related jobs are combined, expanded, or eliminated.

Graham (1993) used direct experience as a worker on an automotive assembly line to explore the contention that the Japanese style of management increases worker autonomy. To gain access to a midwestern Subaru-Isuzu assembly plant, Graham went through the hiring and orientation process as a new production worker. As a "hidden participant/observer" whose research intentions were unknown to management, the author hoped to gain access to this environment quickly and conduct her research with no disruption of the natural course of events on the shop floor. Graham used her day-to-day observations as a factory worker, informal discussions with 150 co-workers, and formal documents distributed by the company during her 6 months of employment to provide a detailed account of the work performed in the "trim and final" department of the assembly plant.

Graham described her struggle to keep up with a demanding sequence of assembly tasks on a rapidly moving production line and other manual and psychological challenges of factory work in an environment where employee productivity and time-and-motion studies were highly valued. The author divided her findings on the

experiences and reactions of worker into two sections: their compliance with, and their resistance to the Japanese style of management used by the company. Field data was related to seven key features of the author'experience as a plant worker: the pre-employment selection process, orientation training, the team concept used in auto assembly, the *kaizen* (continuous improvement) philosophy at the plant, attempts at shaping the shop floor culture, the plant-wide computerized assembly line, and just-in-time production. The results of the study provide insights into individual versus collective reactions to management pressures for higher productivity and spontaneous versus planned resistance to management initiatives. Based on the study, the author questions the contention that the decentralized authority associated with Japanese management increases worker autonomy.

Workplace ethnographies in diverse settings. Barley (1996) argued that the work of technicians, who function in settings as diverse as off-shore oil rigs and hospital emergency rooms, is indicative of fundamental changes in the nature of contemporary work. Due primarily to innovations in technology and changes in the economy, work has become more technical, technical expertise has become more unevenly distributed, and the roles of technicians are less readily formalized. Barley and his colleagues show evidence of these changes in their integrated program of ethnographic research on the work of technicians in many settings (Barley, 1996). Ethnographies have yielded rich descriptions of the work of science laboratory technicians, computer hot-line support technicians, emergency medical technicians, automobile service technicians, customer service engineers, radiology technicians, library technicians, medical laboratory technicians, and computer programmers (Barley, 1996; Barley and Orr, 1997). Hodson's (1998) review and classification of 108 organizational ethnographies, including those of Barley and colleagues, shows this group of studies to be a rich source of insights into the nature of work, yet underutilized by organizational, occupational, and educational researchers. Zuboff's book, *In the Age of the Smart Machine,* is another product of ethnography in organizations that has become a major chronicle of how information technology has fundamentally changes the ways in which worked is accomplished. Her study followed a bottom-up approach to the examination of eight organizations with several industries which were all undergoing significant technical reorganization of their basic work systems (Zuboff, 1988).

Research Methods in Studies of Work

Several research methods, mostly from the qualitative tradition, have been used in these studies of work. Organizational ethnography provides deep insights into the nature of work, yet only recently has this method been used in the workplace (Hodson, 1998). Garfinkel (1967) defines ethnomethodology as 'the study of a particular subject matter: the body of common-sense knowledge and the range of procedures and considerations by means of which the ordinary members of society make sense of, find their way about in, and act on the circumstances in which they find themselves" (p. 4). Ethnomethodology is not restricted to any particular domain of knowledge and can be used as a sense-making technique in any context with uncharted dimensions. This definition of ethnomethodology reflects Van Maanen's (1982) five principles that address the procedures and content of all qualitative research.

(1) *Analytic induction.* Qualitative research begins with close-up, detailed observations and builds generalizations from the ground up. Prescriptions are tentatively offered on the basis of their ability to fully contain the available data.

(2) *Proximity.* The investigator should witness first-hand the phenomenon he or she proposes to understand, and not rely on reports of such. People should be observed engaged in activities that matter to them, the performance of which is, to them, of more importance than their performance in front of the investigator.

(3) *Ordinary behavior.* Qualitative studies occur in the natural world of those studied and examine their everyday activities. Whatever interrupts, alters, or distorts these ordinary activities is to be minimized.

(4) *Structure as ritual constraint.* The meanings of human actions and the contexts in which they occur are distinctive features of qualitative research. To ignore these features is to impose structure rather than discover it.

(5) *Descriptive focus.* Qualitative research seeks to fully describe what is occurring in a given place and time. The aims of revelation and disclosure take precedence over explanation and prediction (p. 16).

Mintzberg (1979) described several basic themes that emerged from three major research projects in which he participated to support his contention that qualitative research is "direct research." Rather than producing prescriptions through deductive methods, this research was as descriptive and inductive as possible. The research included many elements of organizational life using the organization's own terms, rather than focusing on a few variables that were measured in perceptual terms. Mintzberg uses the analogy of a marble cake to show how researchers examine an organization in ways that have nothing to do with how it functions. When researchers force the organization into abstract categories by using their terms rather than its own, the researchers are reduced to using

perceptual measures, which often distort the reality. Rather than appreciating the whole marble cake, rich in swirls and patterns, researchers focus on a slice of the organization with the discrete variables that interests them. Then they make interpretations about the slice as if it was the entire organization. Instead of analyzing the elements of discrete variables, Mintzberg's research synthesized the elements into clusters that show various configurations of organizations as ideal or pure types. In contrast to quantitative approaches to research, Mintzberg emphasizes research as a journey, not a destination.

Webb and Weick (1979) made a case for greater reliance on unobtrusive measures (that is, data collection methods other than surveys and self-reports) in multimethod organizational research. They support this contention with several characteristics of unobtrusive measures that make them desirable for studying organizations. Unobtrusive measures allow investigators to match the dynamic nature of the phenomenon of interest with variety in the sensing devices that are applied to it. Although interpretation of the data collected becomes more difficult, multiple measures that converge on the phenomenon are preferred. Whereas surveys and self-reports are best used with those who are more articulate— a practice that results in the overrepresentation in data sets of the views of those who have higher level positions, unobtrusive measures can be used with those at all levels of the organization. Unobtrusive measures also allow investigators to capture information that allows fuller interpretation of events, but because it may seem benign, untraditional, or puzzling, may otherwise be ignored.

In another example of the benefits of mixing quantitative and qualitative research techniques, McClintock, Brannon, and Maynard-Moody (1979) described a strategy for combining stratified sampling with qualitative analysis. Using a technique called the *case cluster method* of data sampling, the authors studied the complexity and predictability of a broad range of tasks performed by those at four hierarchical levels of a university. Study participants in four job categories (administrative, faculty, non-faculty professional, and clerical/maintenance) described the tasks they performed. Participants then sorted the tasks by complexity and predictability. Using the four combinations of two, bi-level factors (simple/complex, predictable/unpredictable), a wide range of tasks from jobs throughout the organization were categorized into the four quadrants of a matrix for task uncertainty. With tasks as the unit of analysis, data were then analyzed qualitatively to discover patterns in the structure of tasks that contribute to their uncertainty.

Adler and Adler (1994) describe the role of observational techniques in ethnomethodology as a way of uncovering processes that are below the level of conscious awareness, at the taken for granted level. This level of sensitivity is possible from any of Gold's (1958) four perspectives from which observers may gather data: the complete participant, the participant-as-observer, the observer-as-participant, and the complete observer. Ethnographers prefer to use observational techniques that focus on very micro exchanges such as the means people use for taking and yielding the floor during conversational exchanges. Data from audio- and video-taping are analyzed to bring readers as close to the situation as possible by showing conversational overlaps, pauses, intonations, and distractions. The authors suggest that observational data gathering in ethnography continues until researchers approach theoretical saturation (Strauss and Corbin, 1990)— that is, when the generic features of their new findings consistently replicate earlier ones.

These research methods have been used to examine the question of how skilled performance is developed. Yet, *how well* have researchers used these methods to examine this issue? That is, how is research designed most effectively to study this question? The following questions are posed, and then revisited at the end of the paper, as the basis for designing research to answer this question.

- What group of workers is selected for study? Why this job or occupation?
- How many individuals or cases should be studied? Is the unit of analysis the individual worker or a homogenous group of workers?
- What roles do the materials and conditions in the task environment play in the development of skilled performance?
- During how long a time period should this group of workers be studied? Is six months too short a time period? Is three years too long?
- How is the data analyzed? Detailed analysis of each worker studied? Cross-case analysis of individual learning? Of group learning? Analysis of themes with other studies?

Answers to these questions can be obtained from two seminal studies of how skilled performance is developed. Of the studies reviewed in this paper, those by Scribner (1984) and Suchman (1987) best address the question, 'How do people integrate prior learning and experience with the present demands of a task to perform it skillfully?"

Scribner (1984) studied the work of two groups of dairy plant workers— product assemblers and wholesale delivery drivers. Product assemblers prepared product orders, composed of milk and other dairy products, for shipment to customers based on computer-generated order forms. Wholesale delivery personnel were responsible for delivering orders to customers, including computing the dollar value of the dairy products on invoices. Scribner

studied these tasks— assembling product orders and pricing delivery invoices— to compare the work strategies of experienced workers with those new to the tasks. Workers in this environment were presumed to rely on a combination of procedural knowledge from task-specific rules and pragmatic knowledge gleaned from experience. Greater understanding was sought about the different roles these types of knowledge played in the work strategies of experts and novices. Support was sought for the premise that cognitive skills take shape in the course of participation in socially organized practices. Thus, learning in the context of practice would be an essential determinant in the development of skilled performance.

Reflecting the wide range of institutional and retail customers served by the dairy, each dairy order was unique in size and composition; consequently, order prices varied. Despite the availability of procedures and computer forms for assistance, wholesale delivery personnel adopted their own alternative methods for pricing delivery invoices (for example, effort-saving algorithms and personal crib sheets) that were not used by those new to the task. At the close of each delivery, experts made use of physical aspects of the environment, such as product containers and shipping cases, as cues for computing subtotals for customer invoices. Their own pragmatic problem solving gave rise to these strategies for preserving mental effort on the job. A parallel demonstration of pragmatic thinking to save manual effort was apparent among product assemblers. Economy of effort functioned as a criterion distinguishing skilled from amateur performance. As opposed to relying primarily on procedural knowledge, successful work strategies were goal-directed and varied adaptively with the changing properties of the problems and resources encountered by workers in the task environment. These contextual factors influenced the development of skilled performance and illustrate how workers in a production environment learn and adapt their skills on the job.

Another important study of how knowledge is constructed on the job was done by Lucy Suchman. Suchman (1987) studied human-machine interaction to demonstrate the limited role that planning plays in shaping the actions of photocopy machine users. The study also demonstrated how a better understanding of human intelligence can contribute to the design of interactive machines. A major objective of her study was to examine the structure of *situated action*—purposeful action that depends in essential ways on material and social circumstances— to capture "those fleeting circumstances that our interpretations of action systematically rely upon, but which our accounts of actions routinely ignore" (p. 109). Instead of reports of action such as interviews or observations by the researcher, Suchman examined transcript data from videotapes of users interacting with a photocopier. A characterization of the interaction between user and machine was constructed using a four-part analytic framework. The framework categorized displays and messages generated by the machine and distinguished the user's actions that were recognizable by the machine from those that were not (while the videotape captured all user and machine behaviors, only user actions interpretable electronically were available to the machine).

The study showed that the coherence of the user's actions was largely unavailable to the machine. The verbal protocol from the videotapes allowed the researcher to identify the problems encountered by the user and interpret the user's responses to the problems. Because a full record of machine and user behaviors was available, points of confusion could be precisely located. Detailed study of the situated actions of users could then be used as the basis for recommendations for improving the design of photocopiers.

In these studies both Scribner and Suchman depart from pure forms of qualitative or quantitative research by combining complementary features of each approach. Scribner's study of dairy workers demonstrated the role of context in the development of cognitive skills by combining an ethnographic approach to data collection with a research design based on controlled experimentation. Scribner's ethnographic description of the dairy was followed by observational methods to determine which tasks were involved in certain work practices, to describe their characteristics, and to discover the constraints imposed by the work setting. Experimental methods based on the problem solving research of Newell and Simon (1972) were then used to refine these task descriptions and to analyze component knowledge and cognitive processes involved in their accomplishment. Suchman (1987) produced a case study about human-machine communication generated from the perspective of an anthropologist. However, departing from traditional anthropology, Suchman examined individuals, not groups or larger social systems. Moreover, her interest was not primarily in social or cultural processes, but in human-machine interaction. Thus, the rich descriptions of how working knowledge is constructed from both Scribner and Suchman relied on adaptations of qualitative and quantitative research methods to meet the purposes of their studies.

Questions to Guide Further Study of Skilled Performance

Now we return to the questions on designing research to study how people integrate prior learning and experience with the present demands of a task to perform it skillfully.

- How many individuals or cases should be studied? Is the unit of analysis the individual worker or a homogenous group of workers? These considerations should be justified on theoretical grounds as the basis of research methodology.
- Focus on how individuals learn to perform their work. This involves (a) describing whatever learning occurs during task performance, as well as (b) identifying prior formal and informal learning needed for skilled performance. Because the study is focused on how individuals integrate prior learning and experience with the present demands of the task, formal job preparation must be completed prior to the start of the study.
- During how long a time period should this group of workers be studied? Is six months too short a time period? Is three years too long? The study should identify what contributes to the learning needed for skilled performance. Contributions may come from formal job preparation, work experience (apprenticeship), continuing education, and other factors. The study should continue long enough to describe the basis for making these distinctions. Thus, the length of the study should also be justified on theoretical grounds.
- Describe the overall situation and goals of the work. This includes describing the environment, setting, history, and background.
- Describe in detail how the work is performed in a phase-by-phase manner. Work analysis methods should be used and the descriptions should be verified for authenticity by participants.
- How is the data analyzed? Detailed analysis of each worker studied? Cross-case analysis of learning across individuals and groups within the study? Analysis of themes with other studies? All of these?
- What roles do the materials and conditions in the task environment play in the development of skilled performance?

A well-designed study of how skilled performance is developed would fully answer these questions.

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Critical Reflection on the Shop-Floor

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The purpose of this study was to describe on-the job learning and to find out if flexible craftsmanship'is a useful measure of output for on-the-job learning. The results indicated that flexible craftsmanship is no neutral measure of output, because it takes into account only the employer's view of ideal employees.' A certain form of on-the-job learning (namely critical reflection) may itself serve as a more neutral measure of output for further research.

Keywords: Critical Reflection, On-The-Job Learning, Informal Workplace Learning

Problem Statement and Theoretical Framework

The research reported in this paper is the first, explorative phase of a four-year research project that started with the question of how to describe and explain the informal on-the-job learning process the aim of the first phase of this research was to find out if flexible craftsmanship really is a useful measure of output for on-the-job learning. Marsick and Watkins (1990) define informal and incidental learning as the learning that results from the natural opportunities for learning that occur every day of a person's working life when the person controls his learning. According to Marsick and Watkins (1990), informal learning can be planned or unplanned and involves some degree of conscious awareness that learning is taking place. Incidental learning is expected to be a sub-category of informal learning and is defined as a by-product of some other activity, such as task accomplishment, interpersonal interaction, or trial and error experimentation. Incidental learning is unintentional and unexpected and almost always takes place although people are not always conscious of it (Marsick and Watkins, 1990).

Furthermore, the underlying idea was that the informal on-the-job learning process should serve a purpose, or lead to a specific objective. On-the job learning should result in a better, more competent employee. To this end the concept of 'flexible craftsmanship' was developed. As in many professions changes take place in the content and organisation of work, flexibility is an important and necessary aspect of craftsmanship. Sternberg (1985, 1988) connects flexibility with the concept of experiential intelligence which relates to two aspects of intelligence that are counterparts, namely coping with novelty and automatisation. The newer the tasks and situations are that a person is confronted with, the more they will appeal to his ability to cope with novelty. On the other hand, if experience of the same kinds of tasks increases, the appeal is to his ability to develop routines. Too much emphasis on experience variation may come at the expense of efficiency and productivity, whereas too much emphasis on experience concentration may come at the expense of flexibility and employability (Thijssen, 1996). This means that flexibility is not the be-all and end-all; for an effective and productive performance, there needs to be a balance between routine and flexibility. In the research, informal learning processes were therefore assumed to influence both craftsmanship (the ability to function effectively and efficiently in a profession) and flexibility (the ability to cope effectively with change). Since flexible craftsmanship is a newly-developed concept on which no further literature is available, the aim of the first phase of this research was to find out if flexible craftsmanship really is a useful measure of output for on-the-job learning. In order to be able to study on-the-job learning more extensively in the next phase of research and in a less explorative manner, the other aims of the explorative phase were to demarcate this concept more clearly, and to gain an insight into the factors that are influencing it.

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Research Questions

The research questions for the first exploratory phase of the research are:
1. Is flexible craftsmanship'an adequate measure of output for informal on-the-job learning?
2. How can informal on-the job learning be better demarcated?
3. What factors (individual and organisational) influence informal on-the-job learning?

Methodology

To answer the above research questions, case studies were carried out in seven organisations: two banks, three factories (a cheese factory, a packaging factory, and a textile-printing factory), a call centre, and the Post Office (organisation). These case studies function as a preliminary investigation for the main research. On the basis of the results of the case studies, more extensive research will be conducted, in which the findings of the case studies will be tested. A case-study design was chosen because of the need to research the reality value of the limited conceptual model by identifying the viewpoints of participants in organisations (Swanborn, 1996) and because of the need to construct a theory arising from the observations. Explorative' means that not just the initial concept (flexible craftsmanship) was tested, but also that allowance was made for alternative explanations concerning the topic of the research. The cases were analysed in a comparative way. The aim of comparing the results of the case studies was to build a general explanation model that would fit each of the individual cases, even though cases would vary in their details (explanation building Yin, 1994). Since the case studies were explorative, no specific criteria were used for selecting them, except for a reasonable balance between services and industries. For reasons of efficiency, an approach was made to organisations that had already had contact with other departments of Stoas.

Table 1: Organisations and respondents

Organisation	Respondents			
	Senior Managers	Line Managers	Shop floor Workers	Total
1. Cheese Factory	1	1	2	4
2. Packaging Factory	2	1	1	4
3. Call centre	1	1	2	4
4. Bank 1	2	1	2	5
5. Bank 2	2	1	2	5
6. Textile Printing Factory	2	1	2	5
7. The Post Office	2	1	2	5
Total	12	7	13	32

In order to form an idea of the view of management and its strategy, as well as of daily practice on the shop floor, the respondents in these organisations represent different hierarchical levels. The first interview to be conducted in these organisations was with a senior manager concerned with personnel. The (summarised) interview questions put to this manager were:
- Can you give an overall impression of the company's background?
- What kind of developments does this company have to contend with?
- What are the consequences of these developments for the definitions of craftsmanship and flexibility? What is your definition of a 'good employee'?
- What is company policy towards the learning organisation and on-the-job learning? Is this company a learning organisation? Why (not)?

Subsequently, line managers and shop-floor workers were interviewed. Apart from the same interview questions as were put to the senior manager (sometimes aimed more at the department of the organisation people work in), these employees were asked the following (summarised) questions. (The interview with the line managers related to the jobs of their employees instead of their own job):
- Can you describe your function and the position of your function in this organisation?

- Can you discuss the recent changes in your job? What consequences did these changes have for you? Did this lead to problems in your functioning? What were they?
- Do you perceive yourself as a craftsman or a 'good employee'? Why? Do you perceive yourself as flexible? Why? (line manager: What is your definition of craftsmanship, a 'good employee', a flexible employee? What bottlenecks exist concerning craftsmanship, etc.)
- Are you stimulated to develop your craftsmanship? In what way? Are you stimulated to be flexible? In what way? (line manager: What measures are being taken to stimulate craftsmanship, flexibility and employability?)
- Can you learn in and from your job? Why? Can you give examples of things you have learned in the past year?
- Do you reflect on problems in your work and how to solve these problems? Can you give an example? Do you ever try to improve aspects of your work or your way of working? Can you give an example? Is it a challenge to learn? Why?

The interviews were written into reports, in which the topics discussed were clustered under the following headings: background information, developments, definition of flexible craftsmanship and a 'good employee', on-the-job learning, factors influencing on-the-job learning. Reports of the interviews were sent to the respondents for feedback. Next, the results of all seven case studies were summarised in a data-matrix containing the same topics as the interview reports. If interviews with participants within one organisation were not convergent this was also noted. Subsequently, the results of each of the topics were summarised in a way that fitted all the individual cases in general. These results are discussed in paragraphs 4.1 to 4.6. Due to limited space, and in order to enhance the readability of this article, it was decided to illustrate the results with some examples, instead of systematically discussing all the cases in the same degree of detail. However, if some of the cases do not support the summarised results, this will be explained.

The research reported here is explorative, and started with quite broad research questions. It was, however, considered necessary as a first step in the total research process to start as close as possible to real-life situations in organisations, in order to make the right decisions and create an appropriate research model for the continuation of the research. Furthermore, an interview-based approach with a semi-structured interview guideline brings its own limitations when discussing a topic like informal workplace learning, which is mainly tacit. However, for the first phase of the research, this was considered the best option; for the continuation of the research, more specific research instruments will be developed on the basis of the results that are being gathered.

Results

The following paragraphs discuss the results that emerged from the case studies. The first research question is answered in paragraphs 4.1 to 4.3; paragraphs 4.1. and 4.2 discuss the problems that emerged concerning the concept 'flexible craftsmanship'. Paragraph 4.3 discusses the relationship between informal on-the-job learning and flexible craftsmanship. Paragraph 4.4 introduces both an alternative measure of output for on-the job learning (instead of 'flexible craftsmanship') and an answer to the question of how on-the-job learning can be better demarcated. Paragraphs 4.5 and 4.6 discuss respectively individual and organisational factors that influence informal on-the-job learning.

The Conflict between Flexibility and Craftsmanship

The first thing to emerge was that the concept of 'flexible craftsmanship' is more complex than had been expected. Flexibility may well be incompatible with craftsmanship. As a result of competition, generally speaking, two things may occur in an organisation. There may be strong pressure either on quality or on efficiency (or both). In the latter case a great deal is invested in computerisation and, as a result, jobs may be downgraded or disappear altogether. The conflict between flexibility and craftsmanship is shown most clearly by the case study of the call centre. In the call centre, operators have to answer calls from customers who are looking for a telephone number (8008-service). Here, flexible employees are seen as those who can adapt easily to the new demands the employer is making on the profession. These demands are to comply with the standards regarding the number of calls handled per hour, and to bring the call promptly to an end in a charming way if questions from customers prove too time-consuming. This new definition of craftsmanship conflicts with the old one: always try to help a customer, no matter how much time it may take. Employees, who in the old situation used to be seen as good operators, in the new situation may well be the ones that do not fit the definition of a good operator.

The other cases also showed the conflict between flexibility and craftsmanship. Jobs may not always be downgraded, but very often jobs have changed so radically that no part of the old job remains. Many workers in the cheese factory, the packaging factory and the textile-printing company were very fond of their 'old' craftsmanship being a traditional handicraft. Flexibility for them meant saying goodbye to their old craftsmanship and accepting what was sometimes completely different craftsmanship. At the banks this was especially the case for employees in administrative jobs that had been computerised, and for all the specialists at the bank who nowadays have to become generalists.

The question then is who is the most flexible craftsman, the one who accepts that his job has been downgraded or radically changed, or the one who puts up the greatest resistance? Flexible craftsmanship seems to be influenced by the extent to which one is able to come to terms with the demands made on the profession by management and one's willingness to leave the old craftsmanship behind. Flexible craftsmanship is thus not a neutral concept, but would seem to be an output measure of on-the-job learning seen purely from the employer's viewpoint.

Flexibility or Employability?

As stated before, the changes that occur in jobs may sometimes be quite radical. In many jobs very little of the former tasks remains. Some of the companies in the case studies (the Post Office, the call centre, and the giro bank) are in a state of transition from being a state-owned company to becoming a private company. This transition is bringing about many changes in jobs on the shop floor. Post Office counter clerks suddenly have to become commercially-minded and to sell registered post. In the call centre and the giro bank the transition from being a state-owned company to becoming a private company is putting great pressure on efficiency. Many jobs have become Tayloristic and, thanks to computerisation, many others have ceased to exist. In the giro bank those jobs that are left are of a higher level (skilled craftsmanship). At both the banks many administrative jobs have disappeared altogether because of computerisation.

Since employees cannot easily be dismissed, organisations often try to make attractive offers to those employees whose jobs have disappeared or to employees who are unable to comply with the new demands being made of them. They are often offered different positions within the organisation. Alternatively they may choose either to train for another position in the company, or to follow a course of training of their own choice. If they choose the latter, the deal is that the leave the company after a certain period of time. Many employees, however, remain in their old jobs and refuse the offers made to them, even though they know that their job will disappear or that they do not like the changes that are taking place in their job. A personnel manager at the Post Office stated that organisations with routine, rather undemanding jobs that have ceased to exist or will soon do so should try to ensure that their employees move higher in Maslow's pyramid (self-development) so that they can look for another job on their own initiative.

This leads one to the conclusion that flexibility should not be defined on the basis of employment with one specific employer. The ability to take responsibility for one's own career if one does not like the changes that are taking place in the job, and to continue this career with another employer may also be seen as a characteristic of a good employee. It is noteworthy that this ability is not only in the interests of the employee but also in those of the employer, if, for example, jobs change or disappear and employees cannot be dismissed because they are protected by law.

The Influence of the On-the-job Learning Process on Flexible Craftsmanship: Willingness or Potential to be Flexible?

Before starting the case studies it was assumed that flexible craftsmanship was influenced by the on-the-job learning process. Flexible craftsmanship was perceived as a kind of competence, something people can learn. However, the case studies made it clear that on-the-job learning is not the main factor that influences flexibility. More important than the potential of people to be flexible is their willingness to be so. Flexibility could thus better be defined as the willingness to cope effectively with change, rather than the ability to do so. In the packaging plant, an effort is being made to make shop- floor workers more flexible. Shop-floor workers employed in different positions on the same machine, or on different machines in the same production line, should be able to replace each other when a colleague is ill or on holiday. However, the different positions on a machine or production line represent different levels of craftsmanship and thus also different levels in status. A production manager explained that the willingness of shop-floor workers to be more flexible is limited when these tasks do not match their feelings of status or occupational identity. The fear that their old position is endangered, and the

fear of failure also plays a role. Furthermore, workers fear an unfamiliar social environment, and especially new colleagues and supervisors. At the banks and the Post Office employees are sometimes required to work at another location. Although the extra travelling time may form a significant barrier to flexibility, the fear of a different social environment was often mentioned as a much bigger barrier. In the cheese factory and the textile-printing office also it was stressed that some workers simply do not want to be flexible, because being flexible often means insecurity and investing extra energy in learning other tasks (see paragraph. 4.5 motivation for learning).

Critical Reflection

Respondents were asked not only for their views on the concept of flexible craftsmanship, but also for their own definition of 'a good employee' or 'a real craftsman'. It emerged that many respondents, especially in the packaging factory, the cheese factory and one of the banks, mentioned the importance of characteristics such as thinking critically about the whys and wherefores "Why are things organised like this? Can the work be done more efficiently? Why do I work like this?" This definition implies an employee who can distance himself from his work and reflect on it and on the changes that are taking place, instead of one who does what he is expected to do and follows changes uncritically. A personnel manager at a bank underlined the fact that, instead of working harder and harder to meet the increased work pressure, people should in particular learn to work differently. Employees should be able to step back occasionally from their daily routine and devote more attention to self- and time management. A production manager at the cheese factory observed that real craftsmen are not monkeys who can perform tricks but people who contribute ideas towards the process, who reflect on the whys and wherefores, and who can think ahead. A plant manager at the packaging factory commented that real craftsmen can raise work processes and work problems to a higher level and are the employees who like to discuss their knowledge with others. At the organisational level too critical reflection is important. When managers are asked for their definition of the learning organisation' they often mention the importance of learning from mistakes. The plant manager of the packaging factory felt that this should not be limited to mistakes inside the company only; complaints from customers should also be handled very carefully. The supervisors of the technical service in the textile-printing factory complained about their mechanics' development. According to them, the mechanics were stuck in hierarchical thinking and did not exercise their own responsibilities sufficiently. As soon as the supervisors tried to delegate responsibilities to them, the mechanics came back to them, asking what they should do. For this reason the supervisors organised a 'wake-up' training, which started by inviting the mechanics to criticise the organisation. Then, the long list of organisational problems that emerged was categorised and reduced to a top-seven' by a voting procedure. Subsequently, the problems were assigned to different teams to clarify and to find possible solutions to. This shows the importance they attached to critical reflection, although nobody explicitly mentioned it. Stimulating critical reflection here was a means of improving the performance of both the individual mechanics and the technical service.

This leads one to the conclusion that, for the next phase of this research, one aspect of learning that Marsick and Watkins (1990) distinguished is especially relevant, namely critical reflection. Instead of the concept of flexible craftsmanship, it is rather the concept of critical reflection that may serve as a better, more neutral output measure of on-the-job learning. Moreover, this will lead to a better demarcation of the concept on-the-job learning. The research of Marsick and Watkins (1990) showed that critical reflection enabled people to challenge norms and to examine the assumptions behind their reasoning and actions. They noticed that "people learned best when they were able to ask questions about why they saw the world as they did, whether their thinking was correct, or how they came to believe a perceived truth that they held sacred" (p.220). Critical reflection relates to understanding one's own standards, goals, and interests, and learning about backgrounds, assumptions and performance objectives, aimed at improvement. The concept of double-loop learning that Argyris and Schön (1978) distinguished is also related to critical reflection. Double-loop learning enables workers to identify, question and change the assumptions underlying workplace organisation and patterns of interaction. Workers publicly challenge workplace assumptions and learn to change underlying values. By confronting the basic assumptions behind prevailing organisational norms, values, myths, hierarchies and expectations, workers help prevent stagnation and dysfunctional habits. Brookfield (1987) defined the process of critical thinking as the process by which we detect and analyse the assumptions that underlie the actions, decisions and judgements in our lives. Essentially it has three stages: firstly, becoming aware that these assumptions exist, secondly, making them explicit, and thirdly, assessing their accuracy and validity. Brookfield mentions some characteristics of people who think critically. Critical thinkers display contextual sensitivity, they become aware of how contexts distort the assumptions that we have, and they see that common sense ideas and conventional wisdom are actually the product of a particular time, place and group of people. The ability to engage in perspective-taking is another

indicator that critical thinking is taking place. Perspective-taking involves people in entering another person's head, seeing the world as they see it. Tolerance of ambiguity is another important indicator of critical thinking. Tolerance of ambiguity means that people are able to take multiple interpretations of the same situation and are sceptical when others say that there is only one cause of a very complicated problem. Critical thinkers are also people who seek and explore alternative ways of thinking and acting, and do so without the pressure of an immediate crisis. Furthermore, critical thinkers are people who challenge group-think, that is, ideas that a group has accepted as sacrosanct. This also means that critical thinkers are alert to premature ultimates, invocations to higher values. Finally, critical thinkers acknowledge the fact that change is fundamental to life and that the future is open-ended.

Critical reflection did not emerge to the same extent as a crucial concept in all cases. Some examples of these cases are the call centre, the giro bank and The Post Office, where jobs are so routine that critical reflection in a way is discouraged. A personnel manager at the Post Office stressed only critical reflection that refers to the self. This manager stated that employees with critical self-judgement are able to detect their own weak spots (for example in selling) and then to ask for help. Continuous learning presupposes a critical view of one's own functioning and that of others. According to the personnel manager, this requires an acknowledgement of one's own responsibility for acting and learning as well as a willingness to be vulnerable. However, what did appear was that both these organisations and the people who work in them do benefit from employable employees who ask themselves if they really want to follow the changes in their job or if they would not prefer to look for another job (look at paragraph 4.2).This also implies employees who are critically reflective. A concept such as employability therefore may be seen as a consequence of critical reflection.

Critically reflection seems to be a way of learning that brings together the interests of both employers and employees, although some employers prefer employees whose critical thinking is positive, and only want employees to reflect critically on themselves, instead of on the organisation, or restrict the importance of critical reflection on the organisation only to higher levels of management. It seems that the extent to which organisations will acknowledge the importance of critical reflection and benefit from it depends on the characteristics of the organisation, as discussed in paragraph 4.6. The benefits of critical reflection to the employee lie in the critical reflection itself, which gives him a feeling of self-determination and which will help him in career development. For the employer, however, it is the economic value of critical reflection that is of importance. Critical reflection is essential for continuous improvement, quality management and innovation - all matters that are vital in order to survive in a competitive economy.

Motivation for Learning

Learning often means that some aspects of a job will change, and that employees will have to leave behind a way of working that they have been accustomed to, sometimes for twenty years or more. This often proves very difficult for people and takes a lot out of them. This applies especially to shop-floor workers who are selected merely to carry out tasks and follow rules that have been set by others, and not to think too much for themselves. All the cases made it clear that learning not only produces benefits but also entails a great many costs (time, energy, and loss of security if learning was a consequence of job changes). This means that employees need a motivation for investing in the learning process.

The importance that people attach to work in their lives is also of influence on their motivation for learning. Many of those who were interviewed made a distinction between employees who work for the money and then go home to continue their lives, and employees for whom work is more important. A personnel manager at a bank said that some employees simply do not want to invest in their work and to exploit their talent because they see challenges in their personal life, rather than in their working life. Employees at the giro bank and the call centre are mostly women who started working because it was an undemanding job that was easy to combine with their family life.

Since informal on-the-job learning and working are inseparable, the motivation to learn will correspond to the motivation to work. In the motives that emerge from the case studies, it is possible to recognise motivational factors from the theory of self-determination (Deci and Ryan, 1985, Deci and Flaste, 1995) that was validated in business facilities (Deci, 1975) and revalidated by Kleinmann and Straka (1996) This theory expects three motivational factors in workplace conditions to have a distinct impact on employee interest in self-directed learning, namely experience of social integration, experience of autonomy and experience of competence.

People feel socially integrated if they believe that their work is acknowledged by their colleagues and superiors and if they feel integrated in the community of work. One factor that would seem to be an important motivation for both work and on-the-job learning is the fact that work is a social event; the operators and the

employees of the giro bank considered this a central aspect of work. The fact that colleagues enthuse each other with a learning attitude was underlined by the production manager at the packaging company. It is, according to him, very important that shop-floor workers have a place that is pleasant, where they can have fun together. On the other hand, employees often resist change because it implies that they will have to work with different people. A bank employee spoke about the days before bank opening hours were extended, when everybody stayed behind after work to let off steam. She always found these times very enjoyable , but nowadays, because opening hours have been extended, everybody rushes straight home after work. This also means that an important moment of collective reflection has disappeared.

People experience autonomy when they have the feeling that they have the scope to act independently and to carry out their work according to their own planning and insights. An operator at the call centre said that the changes taking place in her job are going to make her feel more and more like a robot, which is very demotivating. What was important for her was to 'put something of oneself into the work', for example, by having a pleasant conversation with a customer, or by being able to use her own knowledge and intelligence in the search process. It became apparent from interviews with mechanics in the cheese factory and in the textile-printing factory that the freedom to concentrate work on aspects that have their special personal interest can be a very powerful motivation for working and informal learning. Each mechanic has his own professional hobby and they generally make a division of labour according to this personal interest and expertise. One mechanic in the cheese factory spent many hours of both his leisure time and his time at work writing manuals for computer software so that his colleagues could use them. The fact that employees working for the accommodation services at a bank (which are concerned with moving and arranging workrooms) are able to move freely about the whole building as they see fit gives them a very strong feeling of autonomy, especially when they compare themselves with the desk clerks, who have to sit 'imprisoned' behind their desks all day.

People feel competent if they believe that they can carry out their work successfully and effectively.The work of a packing team supervisor at the packaging factory is quite low skilled, but because her team is the last one in the production line before the products go out to the customer, she feels a sense of achievement when she is able to arrange things at the last minute. A bank employee reported feeling stimulated by the score lists of products sold that are made for each employee, because it gives her an understanding of her own effectiveness. One operator feels successful when she is able to meet the norms for the number of calls handled per hour.

The Influence of Organisational Culture on Critical Reflection

The managers at the cheese factory, the packaging factory and the bank all stressed the fact that the ability to reflect (critically) on one's own performance cannot be seen as an independent variable, since it depends partly on the organisational culture the employees were 'raised' in and the autonomy they have always experienced.

In the cheese factory both the department manager and the foreman reported that shop-floor workers had traditionally been made very dependent on their foreman. If people ever made a mistake they were never trusted again. This can be explained by the fact that the cost of mistakes in the process was very high. When later, more responsibilities were given back to the shop-floor workers, this caused many problems. Direct managers play an important role in this, as they often only think about short-term benefits (running the process with as few problems as possible).

The failure of many attempts to introduce the concept of teamwork may also be ascribed to the fact that many shop-floor workers have learned 'not to think', was the view of a senior training advisor at a bank. At the giro bank employees got so used to their very routine jobs that they were not even able to pass an exam on simple safety training (what to do in the event of a robbery). This was because they simply could not imagine that a robbery might take place. ('In all the 20 years I have worked here no such thing has ever happened.') This leads one to the conclusion that some organisational factors will foster critical reflection, while others will suppress it. Marsick (1987) also argues that some workers have been so conditioned not to raise questions that they may not know how to begin to think critically.

Organisations can foster critical thinking by explicitly rewarding it. At some factories (the packaging factory and the textile-printing factory) a suggestions box is in use. The plant manager at the packaging factory revealed, however, that this does not always work well. In addition to the good ideas that deserve to be rewarded, many suggestions are being submitted out of frustration, or as a result of communication problems with the foreman. "Good teams do not need a suggestions box; they immediately turn ideas into improvements". The plant manager believes that coaching by the foreman is far more effective in fostering critical reflection. A climate of great attentiveness, in which workers with good ideas are (publicly) praised, is vital to the self-confidence that

workers need. This will enable those with creative ideas also to function as a role model for their colleagues. The packaging factory organises a special day each year when teams with good ideas regarding improvements are publicly praised.

It is possible to stimulate critical reflection on the shop floor by involving workers in quality assurance systems. The supervisor of the packing department – the last unit in line – at the packaging factory, has a rather routine job, but ever since she became responsible for quality on her unit she has had to take many decisions concerning product quality. The department manager in the cheese factory stressed that involving workers in formulating the procedures is especially important for the learning process. In this factory one manager made the workers responsible for the quality assurance procedures, while the manager of another department did this all himself. The department manager reported that this has produced two different kinds of culture on the shop floor that will remain even after the managers concerned have left. Since employees have learned to think and function independently, it will be easier for the next manager to give them these responsibilities, and so on. Brookfield (1987) put it this way: "when criticism of prevailing workplace norms is encouraged in some form of collective forum, as is advocated by proponents of quality circles, leaps of imagination that take companies beyond currently accepted modes of production are more likely to take place. Critical thinking, then, can be seen as the central element in improving organisational performance."

Critical reflection means learning from mistakes and not being afraid to look at one's weak spots. A personnel manager at a bank reported that tolerance towards making mistakes' had recently become company policy and that showing one's vulnerability was being stimulated. The fact that this policy is quite hard to put into practice in a bank, where large amounts of money may be involved, is demonstrated by an employee of that bank, who said that she had not even noticed this shift in company policy. A training manager in the bank also said that showing one's vulnerability is not very easy in a culture where people have their knowledge and competencies to thank for their positions. Many employees hesitate to share their knowledge with others or to ask their colleagues for help (and admit that they themselves do not know). Allowing other people to say what they think of you is a matter of culture, and implies that there has to be a non-threatening environment. The training manager reported that there is no such culture in the Post Office, which can be explained by the hierarchical, civil service culture that had prevailed for so long. Nowadays employees who feel responsible for the whole course of business at a post office are sought after. Good employees, for example, will go and check that there are no packets of chips left on the cash dispenser, or take appropriate steps when promotional campaigns start before the leaflets are available. Each employee has to act as an entrepreneur, but since the organisation has always been very large and bureaucratic, employees have never learned this kind of behaviour. They hide behind their formal tasks and simply pass their responsibilities on to somebody else.

It is remarkable that many of the employees interviewed said that they did not get enough scope to gain a good understanding of the organisation as a whole. This means that workers often do not know in what kind of framework they are operating, which limits their potential for 'double-loop' learning. Communication between different departments of an organisation, including shop-floor workers, plays a vital role in this. In the textile-printing factory efforts are being made to make a transition from thinking in departments' to thinking in processes'. Workers from all the different supportive departments should become 'partners' of the managers; even other companies may be made partners. The technical department is now cooperating increasingly with the production line; mechanics are becoming more involved in the product, while shop-floor workers are carrying out more and more of the repairs themselves. Communication, however, is a significant problem area in this partnership-thinking. Efforts are being made to have shop-floor workers cooperate with the Research and Development department in innovation processes. One important problem area, however, is the fact that the researchers, who work at a professional level, often think and talk in too abstract a manner to communicate with the workers on the shop floor.

Many supervisors (at the call centre and the textile-printing factory) also stress the importance of communicating company policy to the shop floor. Workers will only be motivated to learn new tasks if they are persuaded by cogent arguments of the necessity for change. A manager at the bank said that as long as new products really are better, bank employees do not mind learning about them, but when they are introduced merely because the competitor also has them, employees grow tired of learning.

The nature of work also has a significant effect on the learning culture. In both the cheese factory and the textile-printing factory the electricians appear to communicate much more with each other than do the mechanics, due to the fact that the work of the former is invisible. The way the work is organised also plays a role. The operators said that they like to think about the mistakes in the computer system they work with, or to invent smart tricks to solve particular problems. However, as soon as the next call comes in, that problem disappears from their computer screen and cannot be retrieved. They find this very frustrating.

Conclusions

The results presented above demonstrate that the concept of 'flexible craftsmanship' is not an effective measure of output for informal on-the-job learning because it takes into account only the employer's view of 'ideal employees'. These results also lead one to the conclusion that a certain form of on-the-job learning (namely critical reflection) may itself serve as a measure of output for further research. This form of learning may be seen not only as a means of achieving a particular objective, but also as a goal in itself, since, according to many respondents, an important characteristic of professionals or 'good' employees is that they learn in a critically reflective way. One other advantage of opting for critical reflection is that this will ensure that the concept of on-the-job learning is demarcated more clearly. Another conclusion is that the critically reflective learning processes of shop-floor workers are influenced by such organisational factors as autonomy, rewards for innovative ideas, tolerance of making mistakes and vulnerability, scope for understanding the organisation as a whole, communication to the shop floor. The next phase of the project will focus on the effect that organisational factors have on critical reflection. Although the prompts to critical thinking most often identified are crises and disorientating dilemma's, it is a mistake to regard critical thinking as occasioned only by trauma (Brookfield, 1987). Moments of sudden insight or self-awareness can also be triggered by events that are fulfilling rather than distressing. It is assumed that part of the effect that organisational factors have on critical reflection will be indirect, via the three motivational factors Deci and Ryan (1985) mention (experience of autonomy, experience of competency and experience of social integration). The characteristics of critical thinkers as mentioned by Brookfield (1987) will be used to make it possible to measure the concept of the critically reflective worker.

Contribution to New Knowledge in HRD

As the transfer of training is a very complex matter, HRD should focus more on how to make use of the informal learning experiences that derive from everyday working life, instead of on formal training. Garrick (1998) states that the debate on informal learning within the fields of management and HRD practice has tended to focus on how informal learning can be enhanced, or what can be done to enable individuals to learn more 'efficiently and effectively' in their day-to-day work. According to Garrick, however, there has been little critique of the uses of informal learning, or of its construction within the master discourse of economic rationalism. This research attempts to break through the biased view of learning organisations taken by management, by illuminating the role of both management and shop-floor workers, and focusing on the value of critical reflection to both the organisation and the individual. Another contribution of this research to new knowledge in HRD is that it focuses not on critical reflection of professionals, but rather on that of shop-floor workers.

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